

CLAIMS

1 1. A display panel manufacturing method, comprising an
2 application process for applying a bonding agent to a
3 plurality of barrier ribs formed on at least one of a pair of
4 substrates, and a connection process for arranging the pair of
5 substrates in opposition and connecting the pair of substrates
6 together via the bonding agent that has been applied to the
7 barrier ribs, wherein the application process includes:

50 a bonding agent holding process for having a bond
51 holding member hold a paste-like bond to form a surface; and

52 a bonding agent applying process for applying the
53 bonding agent to almost an entire top surface of each barrier
54 rib by bringing virtually the entire top surface of each
55 barrier rib into contact with the bonding agent layer, while
56 regulating a degree of contact between the bonding agent layer
57 and the barrier ribs.

1 2. The display panel manufacturing process of Claim 1,
2 wherein the bonding agent applying process includes:

3 a first step for arranging the substrate on which the
4 barrier ribs are formed and the bonding agent in opposition,
5 with a gap between the barrier rib tops and the bonding agent;
6 and

7 a second step for regulating the degree of contact
8 between the barrier rib tops and the bonding agent by

9 controlling the distance between the barrier ribs and the
10 bonding agent.

1 3. The display panel manufacturing method of Claim 1,
2 wherein the bonding agent applying process includes:

3 a third step for placing the substrate on which the
4 barrier ribs are formed and the bonding agent in opposition,
5 with a gap between the barrier rib tops and the bonding agent;

6 a fourth step for bringing one part of each barrier rib
into contact with the bonding agent by controlling the
distance between the barrier ribs and the bonding agent to a
distance at which the bonding agent is applied to the barrier
rib tops as a result of surface tension; and

7 a fifth step for bringing the surface of the bonding
agent and virtually the entire surface of each barrier rib top
into contact by altering the relative positions of the bonding
agent and the barrier ribs while maintaining the distance
between the barrier ribs and the bonding agent to a distance
at which the bonding agent continues to be applied to the
barrier ribs as a result of continuing surface tension.

1 4. The display panel manufacturing method of Claim 1,
2 wherein the bonding agent applying process further comprises:

3 a sixth step for placing the substrate on which the
4 barrier ribs are formed, and the bonding agent in opposition,
5 with a gap between the barrier rib tops and the bonding agent;

6 and

7 a seventh step for bringing the barrier ribs into
8 contact with the bonding agent using a regulating means for
9 regulating the position of the barrier rib tops in relation to
10 the bonding agent.

1 5. The display panel manufacturing method of Claim 4,
2 wherein the bonding agent applying process further includes:
3 an eighth step for altering the relative positions of
the bonding agent and the barrier ribs with the barrier rib
tops in contact with the regulating means.

4 6. The display panel manufacturing method of Claim 4,
5 wherein the bonding agent holding member is a rotating object
6 on whose surface the bonding agent is held; and

7 the bonding agent applying process includes a ninth step
8 for bringing the bonding agent into contact with virtually the
9 entire surface of the barrier rib tops by rotating the bonding
agent holding member to move the point of contact between the
bonding agent and the barrier rib tops along the length of the
barrier ribs.

1 7. The display panel manufacturing method of any one of
2 Claims 1 to 5, wherein the bonding agent applying process is
3 repeated a plurality of times for a same substrate.

1 8. The display panel manufacturing method of Claim 6,
2 wherein the bonding agent applying process is repeated a
3 plurality of times for a same substrate.

1 9. The display panel manufacturing method of one of
2 Claims 4 and 5, wherein the bonding agent is held by the
3 regulating means.

1 10. The display panel manufacturing method of Claim 6,
wherein the bonding agent is held by the regulating means.

1 11. The display panel manufacturing method of any one
2 of Claims 2 to 5, wherein the bonding agent is formed in a
3 layer on a flat plate.

1 12. The display panel manufacturing method of Claim 4,
2 wherein the regulating means is formed from interwoven wire
3 rods.

1 13. The display panel manufacturing method of Claim 4,
2 wherein the regulating means is indentations and protrusions
3 formed on a surface of a bonding agent holding member.

1 14. The display panel manufacturing method of Claim 4,
2 wherein the regulating means is a plurality of half-cylinders,
3 and the barrier rib tops are brought into contact with the

4 curved surface of the half-cylinders.

15. The display panel manufacturing method of any one
of Claims 1 to 5, Claims 8, and 10, and Claims 12 to 14,
further including a process for leveling the barrier ribs
across almost the entire surface of the substrate so that all
the barrier rib tops are at approximately the same height.

16. The display panel manufacturing method of Claim 6,
including a process for leveling the barrier ribs across
almost the entire surface of the substrate so that all the
barrier rib tops are at approximately the same height.

17. The display panel manufacturing method of Claim 7,
including a process for leveling the barrier ribs across
almost the entire surface of the substrate so that all the
barrier ribs are at approximately the same height.

18. The display panel manufacturing method of Claim 9,
including a process for leveling the barrier ribs across
almost the entire surface of the substrate so that all the
barrier ribs are at approximately the same height.

19. The display panel manufacturing method of Claim 11,
including a process for leveling the barrier ribs across
almost the entire surface of the substrate so that all the

4 barrier ribs are at approximately the same height.

1 20. A display panel manufacturing method, for
2 connecting a pair of substrates arranged in opposition via (1)
3 a plurality of barrier ribs formed in a specific pattern on at
4 least one of the substrates and (2) a bonding agent arranged
5 on the barrier ribs, the display panel manufacturing method
6 comprising a barrier rib pattern forming process and a bonding
7 agent pattern forming process, including:

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a first step for laminating the bonding agent and a
material for forming the barrier ribs by forming layers of
certain thicknesses;

a second step for simultaneously removing corresponding
parts of the laminated barrier rib material and bonding agent
to form the specific pattern; and

a third step for transferring the pattern formed in the
barrier rib forming material and bonding agent to the
substrate on which the barrier ribs are to be formed.

1 21. A display panel manufacturing method, for
2 connecting a pair of substrates arranged in opposition, via a
3 bonding agent, which has been applied to a plurality of
4 barrier ribs formed in a specific pattern on at least one of
5 the substrates, the display panel manufacturing method
6 comprising:

7 a barrier rib pattern forming process for forming a

8 barrier rib pattern by pressing a first pattern-forming member
9 onto the barrier rib forming material, the barrier rib forming
10 material being of a set thickness, and
11 a bonding agent pattern forming process using a pattern-
12 forming member having the same pattern as the pattern-forming
13 member used in the barrier rib pattern forming process.

1 22. The display panel manufacturing method of Claim 21,
2 wherein the barrier rib pattern forming process and the
3 bonding agent pattern forming process include:

4 a first step for laminating the barrier rib forming
5 material and the bonding agent by forming layers of certain
6 thicknesses;

7 a second step for simultaneously pressing down the
8 laminated barrier rib forming material and bonding agent using
9 a same pattern-forming member to form the specific pattern;
10 and

11 a third step for transferring a molded pattern formed in
12 the barrier rib forming material and bonding agent to the
13 substrate on which the barrier ribs are to be formed.

1 23. A display panel manufacturing method, wherein at
2 least one indentation and protrusion is formed on the parts of
3 the pattern-forming member used in Claim 21 that correspond to
4 top surfaces of the barrier ribs on which the bonding agent is
5 applied.

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1 24. A display panel manufacturing method, for
2 connecting a pair of substrates arranged in opposition via a
3 bonding agent arranged on a plurality of barrier ribs formed
4 in a specific pattern on at least one of the substrates, the
5 display panel manufacturing method comprising:
6 an indentation forming process for forming at least one
7 indentation on a top of each barrier rib; and
8 a bonding agent arranging process for arranging the
bonding agent in the indentations.

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25. The display panel manufacturing method of Claim 24,
the barrier rib pattern being formed by pressing a pattern-
forming member onto the barrier rib forming material, the
barrier rib forming material being arranged in a layer of a
specific thickness, and

the indentation forming process is performed
7 simultaneously with the barrier rib pattern formation when the
8 pattern-forming member is pressed onto the barrier rib forming
9 material.

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1 26. The display panel manufacturing process of one of
2 Claims 24 and 25, wherein the bonding agent arranging process
3 is performed by injecting the bonding agent into the
4 indentations using a nozzle.

1 27. A display panel manufacturing method, for
2 connecting a pair of substrates arranged in opposition via a
3 bonding agent arranged on a plurality of barrier ribs formed
4 in a specific pattern on at least one of the substrates,
5 wherein a process for arranging the bonding agent on the
6 barrier ribs includes:

an attaching process for attaching a first member to the
barrier ribs;

a first removing process for forming holes in the first
member at positions corresponding to tops of the barrier ribs;

a bonding agent filling process for filling the holes in
the first member with the bonding agent; and

a second removing process for removing the remaining
first member.

28. The display panel manufacturing method of Claim 27,
wherein the adhesion process is performed by applying the
first member to the barrier ribs after a connecting layer is
formed on either the barrier ribs or the first member.

29. The display panel manufacturing method of one of
Claims 27 and 28, wherein the first removing process forms
holes by irradiating the surface of the first member with a
laser.

30. The display panel manufacturing method of Claim 29,

2 wherein the laser irradiation ~~is~~ controlled according to
3 measurements taken to locate ~~the~~ barrier ribs.

1 31. The display panel manufacturing method of Claim 29,
2 wherein a material used for the barrier rib tops absorbs laser
3 light more easily than a material used for other parts of the
4 barrier ribs.

1 32. The display panel manufacturing method of Claim 30,
2 wherein a material used for the barrier rib tops absorbs laser
3 light more easily than a material used for other parts of the
4 barrier ribs.

1 33. The display panel manufacturing method of one of
2 Claims 27 and 28, wherein a photoresist is used as the first
3 member; and

4 the first removing process forms holes by irradiating
5 the first member in a specific pattern and then developing the
6 first member.

1 34. The display panel manufacturing method of one of
2 Claims 27 and 28, wherein the first removing process forms
3 holes in the first member adhering to the barrier rib tops
4 using a grinding method.

35. The display panel manufacturing method of one of

2 Claims 27 to 34, wherein the second removing process removes
3 the remainder of the first member using one of peeling,
4 melting and sublimation.

36. A display panel manufacturing method, for
connecting a pair of substrates arranged in opposition via a
bonding agent applied to a plurality of barrier ribs formed on
at least one of the substrates, wherein a process for
arranging the bonding agent on the barrier ribs includes:

an arranging process for bringing a bond sheet, made by
forming a sheet of bonding agent in advance, into contact with
tops of the barrier ribs;

a transfer process for transferring the bonding agent to
the parts of the barrier rib in contact with the bond sheet;
and

a removing process for separating the bond sheet from
the barrier ribs.

37. The display panel manufacturing method of Claim
36, wherein the transfer process transfers the bonding agent
to the parts of the barrier rib tops in contact with the bond
sheet by pressing the bonding agent sheet onto the barrier
rib tops.

38. The display panel manufacturing method of Claim
37, wherein the transfer process heats the parts of the bond

3 sheet in contact with the barrier rib tops.

1 39. A display panel manufacturing method, for
2 connecting a pair of substrates arranged in opposition via a
3 plurality of barrier ribs formed on at least one of the
4 substrates, and a bonding agent applied to the barrier ribs,
5 the display panel manufacturing method comprising:

6 a applying process for applying the bonding agent to an
7 area on each barrier rib that is at least as large as a top
8 of each barrier rib;

9 a hardening process for hardening parts of the attached
10 bonding agent; and

11 a removing process for removing the parts of the
12 bonding agent that have not been hardened.

13 40. The display panel manufacturing method of Claim
14 39, wherein, in the applying process, a compound of bonding
15 agent and photo-hardening resin is applied to the barrier rib
16 tops; and

17 in the hardening process, parts of the applied
18 compound are exposed to light, causing the exposed parts of
19 the compound to harden.

20 41. The display panel manufacturing method of Claim
21 40, wherein a resin that hardens upon exposure to ultra-
22 violet light is used as the photo-hardening resin, and the

4 light used in the hardening process is ultra-violet light.

1 42. The display panel manufacturing method of Claim
2 41, wherein, in the hardening process, after ultra-violet
3 irradiation has taken place, hardened parts of the bonding
4 agent are heated.

1 43. The display panel manufacturing method of any one
2 of Claims 1, 20, 21, 24, 27, 36 and 39, wherein the bonding
agent is arranged on the barrier ribs using a compound
including a first substance which is more difficult to melt
than the bonding agent.

1 44. A gas discharge panel, including a first
substrate, on which a plurality of pairs of electrodes
extending in a first direction, and a dielectric layer
covering the electrodes have been formed, and a second
5 substrate, on which a plurality of barrier ribs, extending in
6 a second direction differing from the first direction, are
7 formed in opposition to the dielectric layer and the
8 electrode pairs so that the barrier ribs are separated from
9 the dielectric layer and the electrode pairs, wherein the
10 dielectric layer and the barrier ribs are at least partially
11 connected; and

12 the panel is structured such that discharge mainly
13 occurs in parts of the panel separated from the positions

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where the barrier ribs and the dielectric layer are
connected.

1 45. The gas discharge panel of Claim 44, wherein a
2 space between electrodes in each electrode pair has wide and
3 narrow parts; and

4 the narrow parts are located in gaps between parts of
5 the dielectric layer where adjacent barrier ribs are
6 connected.

7 46. The gas discharge panel of Claim 44, wherein the
8 parts of the dielectric layer to which the barrier ribs are
9 not connected are covered with a protective film.

10 47. The gas discharge panel of Claim 44, wherein the
11 parts of the dielectric layer connected to the barrier ribs
12 are thicker than the other parts of the dielectric layer.

13 48. The gas discharge panel of Claim 44, wherein a
14 protective film is formed on the surface of the dielectric
15 layer, and the protective film and the barrier ribs are
16 connected; and

17 the surface roughness of the parts of the protective
18 layer to which the barrier ribs are connected is less than
19 the surface roughness of other parts of the protective layer.

1 49. The gas discharge panel of Claim 44, wherein a
2 protective film is formed on the surface of the dielectric
3 layer, and the protective film and the barrier ribs are
4 connected; and

5 the parts of the protective layer to which the barrier
6 ribs are connected are thicker than the other parts of the
7 protective layer.

1 50. The gas discharge panel of Claim 44, wherein the
parts of the barrier ribs that do not correspond to cells are
connected to the first substrate.

51. The gas discharge panel of Claim 44, wherein the
barrier ribs are at least partially connected to the first
substrate by a bonding agent applied to the barrier rib tops
so as to cover an area narrower than each barrier rib top.

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1 52. The gas discharge panel of any one of Claims 44 to
2 51, wherein gas is enclosed at a pressure of no less than 760
3 torr in a space between the first and second substrates.

1 53. A display panel, formed from a pair of substrates
2 arranged in opposition and connected via a bonding agent
3 applied to a plurality of barrier ribs formed on at least one
4 of the substrates, the bonding agent being applied to at
5 least part of each barrier rib;

6 wherein a substance having one of a different melting
7 point and softening point from a substance used for the part
8 of the substrate connected to the bonding agent is used for
9 the bonding agent; and

10 the pair of substrates are connected near top parts of
11 each barrier rib.

1 54. The display panel of Claim 53, wherein one of the
2 melting and softening point of the bonding agent is higher
3 than one of a melting and softening point of the parts of the
4 pair of substrates connected to the bonding agent.

5 55. The display panel of Claim 53, wherein one of the
6 melting and softening point of the bonding agent is lower
7 than one of a melting and softening point of the parts of the
8 pair of substrates connected to the bonding agent.

9 56. The display panel of any one of Claims 53 to 55,
10 wherein most of an area near the top parts of the barrier
11 ribs is connected to a substrate.

1 57. The display panel of any one of Claims 53 to 55,
2 wherein the display panel is a gas discharge panel in which
3 gas is enclosed between the pair of substrates, and the
4 pressure at which the gas is enclosed is set at no less than
5 760 torr.

1 58. The display panel of Claim 56, wherein the display
2 panel is a gas discharge panel in which gas is enclosed
3 between the pair of substrates, and the pressure at which the
4 gas is enclosed is set at no less than 760 torr.

1 59. A display panel, formed from a pair of substrates
2 arranged in opposition and connected via a bonding agent
3 applied to a plurality of barrier ribs formed on at least one
of the substrates, the bonding agent being applied to at
least part of each barrier rib,

wherein the bonding agent includes a first substance
which is more difficult to melt than the bonding agent.